



Topology optimization of heat exchangers and heat sinks

Haertel, Jan Hendrik Klaas; Lei, Tian; Alexandersen, Joe; Engelbrecht, Kurt; Lazarov, Boyan Stefanov; Sigmund, Ole

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
Haertel, J. H. K., Lei, T., Alexandersen, J., Engelbrecht, K., Lazarov, B. S., & Sigmund, O. (2017). *Topology optimization of heat exchangers and heat sinks*. Abstract from Danish Days on Caloric Materials and Devices, Roskilde, Denmark.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Topology optimization of heat exchangers and heat sinks

**Jan H. K. Haertel¹, Tian Lei¹, Joe Alexandersen², Kurt Engelbrecht¹,
Boyan S. Lazarov², Ole Sigmund²**

¹Department of Energy Conversion and Storage, Technical University of Denmark

²Department of Mechanical Engineering, Technical University of Denmark

jkhk@dtu.dk

Efficient heat transfer is critical for the overall performance of caloric devices. Topology optimization [1] is concerned with optimizing a material distribution within a design domain under given constraints. In contrast to size and shape optimization, topology optimization does not rely on an initial design parametrization which can lead to reduced development time and identification of unintuitive and unanticipated designs. Topology optimization of thermofluid systems has for example been treated in [2] for forced convection problems and [3] for natural convection problems.

Work within our group deals with density-based topology optimization of heat exchangers and heat sinks as well as fabrication and experimental validation of these devices. Figure 1 shows a heat sink design generated using a thermofluid natural convection topology optimization model and the corresponding prototype fabricated by investment casting of Britannia alloy. Moreover, the temperature span over the heat sink predicted by simulation and experimentally measured with an IR camera is depicted.

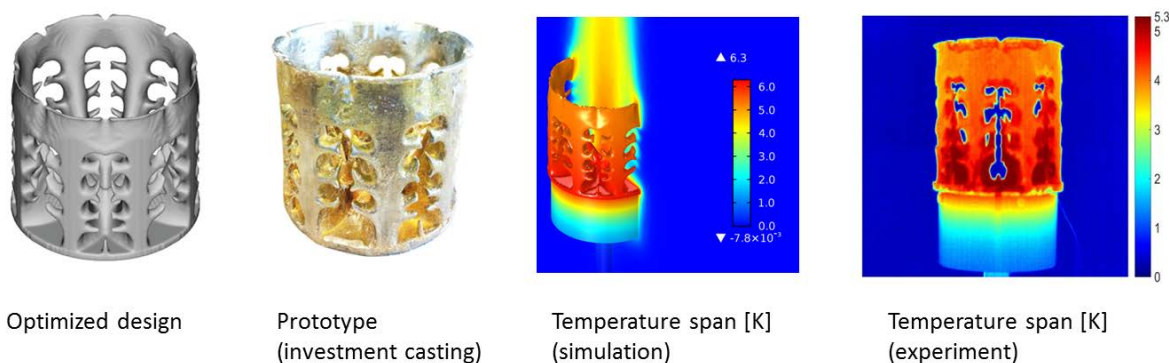


Fig. 1: Optimized heat sink design, fabricated prototype, and simulation and experiment based validation results.

References

- [1] M. P. Bendsøe and O. Sigmund, *Topology Optimization: Theory, Methods, and Applications*, Springer Verlag, Berlin, Germany, 2003
- [2] G. H. Yoon, "Topological design of heat dissipating structure with forced convective heat transfer", *Journal of Mechanical Science and Technology* 24 (2010) 1225-1233
- [3] J. Alexandersen *et al.*, "Topology optimisation for natural convection problems", *International Journal for Numerical Methods in Fluids* 76 (2014) 699-721